PLUGGABLE MODULE FOR A LIQUID OR GAS SENSOR

The present invention relates to a pluggable module for a liquid or gas sensor, as such module is defined in the preamble of claim 1. Liquid or gas sensors are used for measuring pH-values or redox potentials, temperatures, conductivities or turbidities of liquids.

In the following, reference will be essentially to potentiometric sensors, as an example of a liquid, or gas, sensor. Potentiometric sensors are used above all for determining potentials at large resistances, such as is the case for pH-measurements and redox-measurements. With the help of pH-electrodes, or redox-electrodes, as the case may be, the potentials of solutions are sensed.

These electrodes are exposed to strong wear in many cases of application, so that they must frequently be replaced after a short time of operation.

There exist very simply constructed pH-sensors, which consist only of a pH-electrode, without any electronic components. These pH-electrodes deliver a pH-dependent potential, which can be accessed on suitable, electrical connections. Optionally, these pH-electrodes have an integrated temperature sensor, e.g. PT100, for temperature compensation. The potential of the temperature sensor can be accessed at suitable temperature outputs. For measuring, these pH-sensors are usually connected via a cable to a transmitter, which generates a measurement signal from the pH-dependent potential and, as required, from the temperature signal of the temperature sensor.

Besides the described, simple pH-electrodes, or sensors, there are also those with integrated preamplifier for impedance conversion. The output signal of the preamplifier is that potential of the pH-sensor, with, however, instead of the internal resistance of the pH-sensor, which lies in the order of magnitude of 100 M, now the internal resistance of the preamplifier of some few ohms being the determining factor. Consequently, the further transmission and processing of the output potential is considerably simplified for a transmitter. The preamplifier is either fed via a battery or supplied with voltage via a cable.

Furthermore, under the name Direct Line of the Honeywell company, simple transmitters are obtainable, which are mounted directly on the pH-sensors. In this way, it is possible to generate, in the immediate vicinity of the sensor, e.g. a 4-20 mA measurement signal, which can then be transmitted, without more, to the control room.

In the case of all known pH-electrodes, or pH-sensors, it is necessary to calibrate the electrodes after connection to the transmitter, in order to be able to store the determined calibration parameters in the transmitter. Sensor specific information, such as measuring point name, etc., are, as a rule, not obtainable on-site, thus in the immediate vicinity of the sensor.

Recently, a pH-sensor has become known (available from the firm of Endress + Hauser under the mark MemoSens), which is composed of a sensor module and a sensor module head, which can be plugged together. The data and energy transfer between sensor module and sensor module head occurs contactlessly via a connection zone, which serves for galvanic decoupling. Additionally, a digital memory

is provided in the sensor module, for storing, among other things, calibration parameters.

Likewise, it is not possible to check, in simple manner, whether a pH-sensor is capable of functioning. In the control room, one must rely on a secure data transfer on the path from sensor to control room.

An object of the invention is, therefore, to provide, for a potentiometric sensor, a pluggable module, which does not exhibit the above-named disadvantages, which, especially, enables the presentation of sensor-specific information directly on-site, and which, additionally, enables a checking of the measured value sent to the control room and which is simply and cost-favorably manufacturable.

This object is achieved by the pluggable modules for potentiometric sensors as such modules are defined in the claims.

Advantageous further developments of the invention are given in the dependent claims.

The invention will now be explained in further detail on the basis of examples of embodiments presented in the drawing, the figures of which show as follows:

Fig. 1 schematic drawing of a sensor module;

Fig. 2 schematic drawing of a sensor module head;

Fig. 3 schematic drawing of a pluggable module of the invention, in the form of a transmitter with display;

Fig. 4 pluggable module of the invention, with fieldbus connection;

Fig. 5 pluggable module of the invention, for measured value simulation.

Fig. 1 shows a sensor module SM in greater detail. The sensor module SM is composed of a measured value pickup MA (e.g. a glass electrode), which is submerged into the liquid to be measured. The measured value pickup delivers an analog measurement signal, which is preprocessed in an analog signal processing unit SV. Then, the conditioned, analog measurement signal is converted in an analog/digital converter A/D to a digital value, which is processed further in a microcontroller μC1. The microcontroller μC1 is connected with a coil L1 via a modem M/D and a power supply NT. Via the power supply, the entire sensor module SM is provided with voltage. Embodied to fit the sensor module SM is a sensor module head SMK, which is shown in greater detail in Fig. 2. In the sensor module head SMK, a coil L2 is connected via an amplifier V with a modem M2, which, in turn, is connected with an interface S3. Interface S3 is a usual RS485 interface, which serves for data communication with a measurement converter/transmitter (not shown). Sensor module SM and sensor module head SMK are pluggably connectable together. Via the coils L1 and L2, both data and energy exchange can be effected. The two modules are, in this way, galvanically decoupled.

Fig. 3 shows a pluggable module ST1 of the invention, serving as a transmitter with display. Pluggable module ST1 has, like the sensor module head SMK, a coil L2, an amplifier V and a modem M2. In the case of pluggable module ST1, however, in contrast to the sensor model head

SMK, no interface S3 is provided, but, instead, a microcontroller μC, which is connected with a display D and an energy, or power, supply unit EVE. Serving for the data transmission is a radio module F with antenna A. Radio module F is likewise connected to the microcontroller μC. The energy supply unit EVE can be a battery, or solar cells. The energy supply unit EVE also supplies the sensor module SM with voltage. On the display D, sensor-specific information, such as e.g. measuring point designation, can be displayed. To this end, the corresponding data are read out of the sensor module SM. If the pluggable module ST1 serves only for displaying sensor-specific information, then the radio unit F can be omitted. Alternatively, the display D can be omitted, when only a wireless data transfer to a superordinated unit is desired.

Fig. 4 presents an alternative embodiment of the pluggable module ST1, which is connectable with a fieldbus. Here, the microcontroller μC is not connected with a radio unit F, but, instead, with a fieldbus interface S4, which has a cable connection KA for a fieldbus. Interface S4 can be a Profibus-, Foundation Fieldbus-, or HART-interface.

Fig. 5 schematically shows a pluggable module ST2, which serves for simulating a pH-value. Pluggable module ST2 is constructed similarly to sensor module SM. It has, however, no measured value pickup MA. In front of the analog signal processing unit SV is a switch SR, which is operated by the microcontroller μC1. Additionally, a digital-analog converter D/A is provided, which is likewise connected with the switch SR. With the help of the digital-analog converter D/A, a predetermined voltage can be produced, which simulates a measured voltage for

the signal processing unit SV. The simulated measured value (pH-value) can be presented in the display D, which is likewise connected with the microcontroller μC1. Data transfer between pluggable module ST2 and e.g. a control room occurs via a sensor module head SMK. The two pluggable modules ST1, ST2 are embodied as key-ring pendants and can, therefore, be easily brought along, e.g. by service personnel.